Liquidity Traps in a Monetary Union

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Liquidity traps in a monetary union

By Robert Kollmann[a, b, c]

Abstract

The closed economy macro literature has shown that a liquidity trap can result from the self-fulfilling expectation that *future* inflation and output will be low. This paper investigates expectations-driven liquidity traps in a two-country New Keynesian model of a monetary union. In the model here, a rise in government purchases in an individual country has a weak effect on GDP in the rest of the union. The results here cast doubt on the view that, in the current era of ultra-low interest rates, a rise in fiscal spending by Euro Area (EA) core countries would significantly *boost* GDP in the EA periphery.

Euro Area Core inflation % p.a. (YoY)

Source: Eurostat (From Croitorov, Ratto, Pfeiffer, Roeger, 2020)

ECB deposit facility rate (% p.a.)

● Euro Area has been in LIQUIDITY TRAP (LT) since late 2013

● Liquidity Trap: situation in which interest rate is (close to) Zero Lower Bound (ZLB), so that monetary policy cannot stimulate real activity by lowering the policy rate (Keynes (1936), Hicks (1937)).

● Understanding "low rates" environment: key challenge for economic analysis

● Important theme in ongoing monetary policy strategy reviews (ECB, Fed, Bank of Canada etc.)

Andrade, Galí, Le Bihan & Matheron (2021)
Coenen, Montes-Galdon & Schmidt (2021)
Erceg, Jakab & Lindé (2021)

- **This paper: analyzes low-rates environment in MONETARY UNION**

- **2-country NK model with ZLB**

- **Compare two leading LT theories**

"fundamentals-driven" liquidity traps caused by adverse aggregate demand shocks (Keynes (1936), Hicks (1937), Krugman (1998); Eggertsson & Woodford (2003), Holden (2016))

vs.

"beliefs-driven" liquidity traps due to self-fulfilling deflationary expectations (Benhabib, Schmitt-Grohé & Uribe (2001))

- **RESULT: Cause of liquidity trap matters for domestic and cross-country shock transmission in Monetary Union**

- **Model with expectations-driven liquidity trap is better suited for generating PERSISTENT liquidity traps than theory of fundamental liquidity traps**

- **Cross-country spillovers of (persistent) FISCAL POLICY is weaker (even negative) in expectations-driven LT than in fundamental LT**

Benhabib et al. (2002)

ZLB + active Taylor rule: induces multiple equilibria

$$E_t\{\beta u'(C_{t+1})/u'(C_{t+1}))(1+i_{t+1})/\Pi_{t+1}=1$$

Under risk neutrality, certainty equivalent approximation:

$$E_t\Pi_{t+1}=\beta\cdot(1+i_{t+1})$$

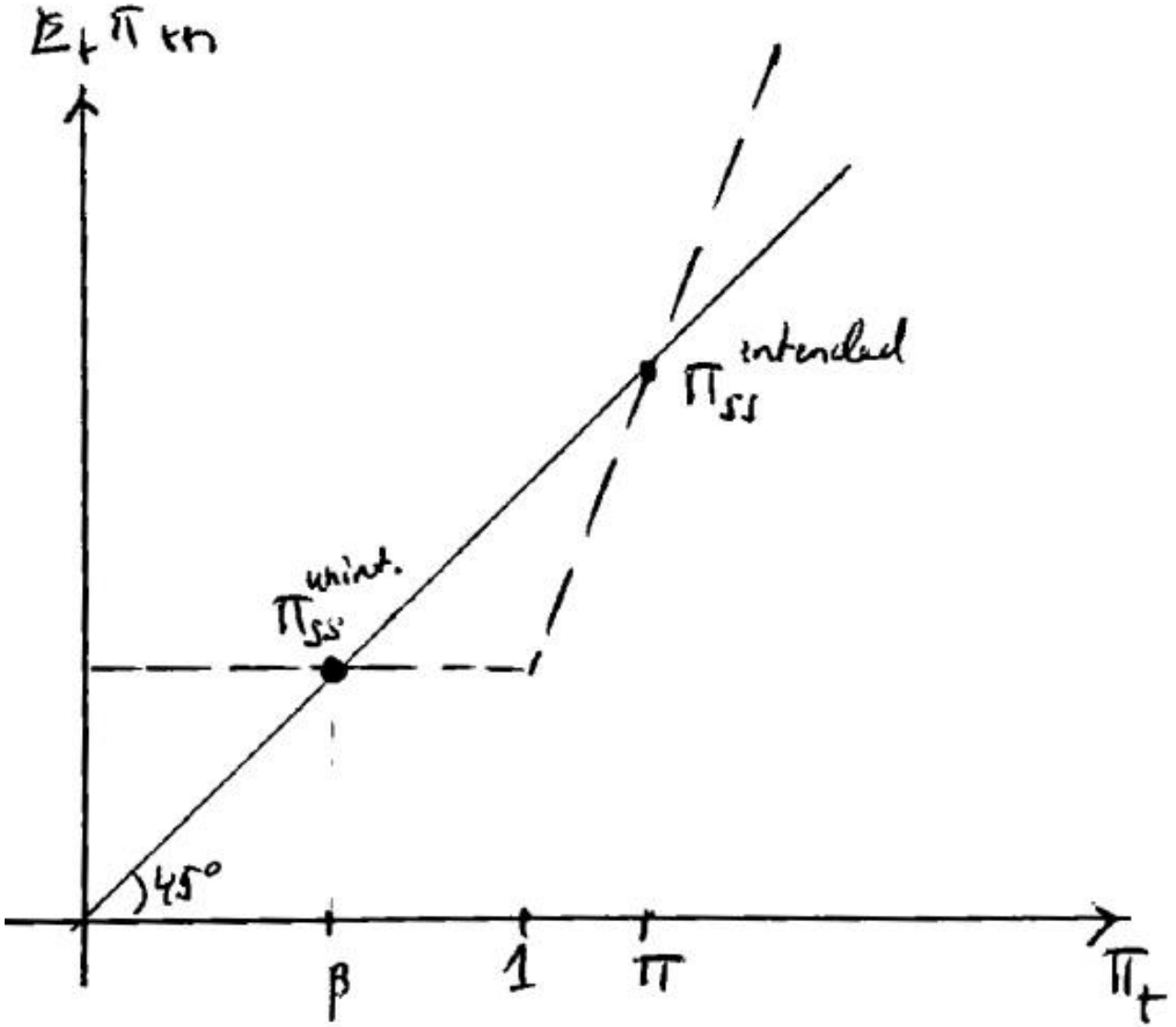
Taylor rule, with ZLB: $1+i_{t+1}=Max[1,\Pi/\beta+(\gamma_\pi/\beta)(\Pi_t-\Pi)]$

$\Pi>1$**: steady state (gross) inflation**

$\gamma_\pi>1$ **(Taylor rule)**

$$E_t\Pi_{t+1}=Max[\beta,\Pi+\gamma_\pi(\Pi_t-\Pi)]$$

Two steady states: $\Pi_{SS}^{\text{intended}}=\Pi>1$ **and** $\Pi_{SS}^{\text{unintended}}=\beta<1$



$$E_t \Pi_{t+1} = Max[\beta, \Pi + \gamma_\pi (\Pi_t - \Pi)]$$

Can construct sunspot (beliefs-driven) equilibria that fluctuate randomly into and out of liquidity trap

Mertens & Ravn (2014)
Arifovic, Schmitt-Grohé & Uribe (2018)
Aruoba, Cuba-Borda & Schorfheide (2018)

Mertens & Ravn (2014), Aruoba et al. (2018) show that, in a liquidity trap driven by pessimistic expectations, a rise in government purchases can have a deflationary effect ⇒ muted effect on GDP (low fiscal multiplier)

Literature on sunspot (beliefs-driven) liquidity traps has considered closed economies.

<u>This paper: beliefs-driven liquidity traps in open economies</u>
<u>Here: monetary union</u>

Companion paper (JEDC 2021):
floating exchange rate

THIS PAPER

Very stylized model (for analytical results) of two-country mon. union

- **Central bank targets union-wide inflation**
- **Taylor principle, when ZLB does not bind**
- **Each country is specialized in production of a distinct tradable good, but consumes domestic & imported tradables (with home bias)**
- **Government purchases local output only**
- **Complete financial markets**
- **Sticky prices (quadratic price adjustment costs)**

Study beliefs-driven sunspot equilibria with occasionally binding ZLB

For standard calibration (persistent shocks)

■ **STRIKING SIMILARITY BETWEEN RESPONSES TO PERSISTENT SHOCKS ACROSS EXPECTATIONS-DRIVEN LT AND NORMAL TIMES "AWAY FROM ZLB"**

INTUITION: PERSISTENT SHOCKS ONLY HAVE MUTED EFFECT ON NATURAL INTEREST RATE & INFLATION

THUS, SHOCK RESPONSES IN PRESENCE OF (POSSIBILITY OF) LIQUIDITY TRAP ARE SIMILAR TO RESPONSES WHEN ZLB NEVER BINDS

■ FISCAL SHOCK TRANSMISSION IN EXPECTATIONS-DRIVEN LT (MONET.UNION)

Negative international transmission of government purchases shocks:
Home gov't purchases ↑ ⇒ Home GDP ↑; Foreign GDP↓

- **Weak union-wide fiscal multiplier**
  Home G ↑ ⇒ union-wide inflation ↓

- **Price stickiness dampens improvement of Home t.o.t.**

⇒ Home G ↑ only generates weak demand spillover to Foreign GDP

RESPONSE TO SIMILAR TO STANDARD NK (AWAY FROM ZLB) & RBC

Beliefs-driven LT:

Inflation is function of the natural real interest rate (rules depending on the ZLB state) [MSV solution]

PERSISTENT TFP, G shocks have little effect on natural real rate ⇒ little effect on inflation

⇒ output response resembles response away from ZLB (under inflation targeting)!

■ FISCAL TRANSMISSION IN FUNDAMENTALS DRIVEN LT (MONETARY UNION)

Krugman (1998), Eggertsson & Woodford (2003), Christiano et al. (2011), Roeger (2015), Holden (2016)

THESE MODELS PREDICT THAT FISCAL MULTIPLIERS CAN BE LARGER IN LIQUIDITY TRAP

Closest to paper here:
Erceg & Lindé (2010), Blanchard, Erceg & Lindé (2016): model of monetary union with liquidity trap triggered by strong rise in subjective discount factor (rise in private saving)

There authors show that cross-country spillovers in monetary union can be strong and positive in liquidity trap

Their model predicts that rise in government purchases in Germany (or in Euro Area core countries) could strongly BOOST Southern European GDP

This theory provides basis for view that fiscal 'austerity' in Germany contributed to slump in rest of Euro Area (Krugman, 2013)

This paper shows:
If liquidity trap is caused by self-fulfilling pessimism (about future inflation and output), then cross-country fiscal spillovers can be much weaker

Why the difference Fundam. LT vs Expect-driven LT ?

- **Fundamental LT**: triggered by big one-time negative demand shock that induces negative value of unconstrained nominal interest rate (need big shock for long LiqTrap)
- Once shock has subsided, the liquidity trap ends, and agents believe that the economy will NEVER enter liquidity trap again
- Small shocks to baseline trajectory have big effects
- Inflation during liquidity trap determined using backward iteration, from trap exit date
- The backward iteration is explosive
- Small shocks around that baseline trajectory have big effects: e.g., G shock during liquidity trap raises inflation after exit from liquidity trap $\Rightarrow$ massive front-loaded rise in inflation $\Rightarrow$ GDP $\uparrow$

SUMMARY OF DOMESTIC & INTERNATIONAL SHOCK TRANSMISSION IN MONETARY UNION

“Fundamental LT” ≠ “Beliefs-driven LT” ≈ Away from ZLB

The model: 2 symmetric countries (Home & Foreign)

- **Preferences/technologies**

$$C_{H,t} \equiv (Y^H_{H,t}/\xi)^{\xi} (Y^F_{H,t}/(1-\xi))^{1-\xi}$$

$$y_{H,t}(s) = \theta_{H,t} L_{H,t}(s)$$

$$E_0 \sum_{t=0}^{\infty} \beta^t \Psi_{H,t} U(C_{H,t}, L_{H,t})$$

$$U(C_{H,t}, L_{H,t}) = \ln(C_{H,t}) - \frac{1}{1+1/\eta} (L_{H,t})^{1+1/\eta}$$

- **Risk sharing**

$$C_{H,t}/C_{F,t} = (\Psi_{H,t}/\Psi_{F,t})/RER_t$$

- **Market clearing**

$$Y_{H,t} = \xi CPI_{H,t} C_{H,t}/P_{H,t} + (1-\xi) CPI_{F,t} C_{F,t}/P_{H,t} + G_{H,t}$$

- **Euler equation**

$$(1+i_{t+1}) E_t \beta (\Psi_{H,t+1}/\Psi_{H,t})(C_{H,t}/C_{H,t+1})/\Pi^{CPI}_{H,t+1} = 1$$

- **Price setting (Phillips equation), k=H,F**

$$\widetilde{\Pi}_{k,t}=\kappa_w \cdot \widetilde{mc}_{k,t}+\beta E_t \widetilde{\Pi}_{k,t+1}$$

- **Monetary policy rule**

$$1+i_{t+1}=Max\{1, \Pi/\beta+(\gamma_\pi/\beta)\cdot(\Pi_t-\Pi)\}\,,\ \gamma_\pi>1$$

Can solve model step-wise
(i) Union-wide (aggregate) variables obey dynamics that is equivalent to closed-economy models.
Due to ZLB constraint have multiple (sunspot) equilibria in UNION-WIDE variables

Market clearing:

$$\widehat{Y_t}=\widehat{C_t}+\widehat{G_t}$$

Phillips curve:

$$\widehat{\Pi_t}=\kappa\cdot(\widehat{C_t}-\widehat{\theta_t}+\tfrac{1}{1+\eta}\widehat{G_t})+\beta E_t\widehat{\Pi_{t+1}}$$

Euler equation:

$$\widehat{1+i_{t+1}}=E_t\{\widehat{\Pi_{t+1}}+\widehat{C_{t+1}}-\widehat{C_t}-(\widehat{\Psi_{t+1}}-\widehat{\Psi_t})\}$$

Taylor rule (with ZLB):

$$\widehat{(1+i_{t+1})}=Max\{-(\Pi-\beta)/\Pi,\gamma_\pi\cdot\widehat{\Pi_t}\}$$

Euler-Phillips equation:

$$Max\{-(\Pi-\beta)/\Pi, \gamma_\pi \cdot \widehat{\Pi}_t\} = -\frac{1}{\kappa}\widehat{\Pi}_t + (1+\frac{1+\beta}{\kappa})E_t\widehat{\Pi}_{t+1} - \frac{\beta}{\kappa}E_t\widehat{\Pi}_{t+2} + \hat{r}_t$$

$$\hat{r}_t \equiv E_t\{(\widehat{\theta}_{t+1} - \hat{\theta}_t) - \frac{1}{1+\eta}(\widehat{G}_{t+1} - \widehat{G}_t) - (\widehat{\Psi}_{t+1} - \widehat{\Psi}_t)\} = (1-\rho)\{-\hat{\theta}_t + \frac{1}{1+\eta}\widehat{G}_t + \widehat{\Psi}_t\}$$

r_t : **natural interest rate (flex-prices)**

ρ : **autocorrelation of exogenous variables**

Aggregate TFP $\uparrow \Rightarrow \quad r_t \downarrow$

Aggregate G $\uparrow \quad \Rightarrow \quad r_t \uparrow$

(ii) Relative (Home vs Foreign) variables are UNIQUELY pinned down!

Indeterminacy of union-wide inflation & interest rate does NOT affect relative variables.

Intuition: monetary policy is common driver that does not affect relative (Home vs. Foreign) variables

Relative quantities depend on terms of trade (tot),

$$q_t \equiv P_{H,t}/P_{F,t}$$

Relative inflation = rate of change of tot

$$\widehat{\Pi_{H,t}} - \widehat{\Pi_{F,t}} = \widehat{q_t} - \widehat{q_{t-1}}$$

Relative output demand

$$\widehat{Y_{H,t}} - \widehat{Y_{F,t}} = -\widehat{q_t} + (2\zeta - 1)(\widehat{\Psi_{H,t}} - \widehat{\Psi_{F,t}}) + (\widehat{G_{H,t}} - \widehat{G_{F,t}})$$

Relative Phillips curves

$$\widehat{\Pi}_{H,t}-\widehat{\Pi}_{F,t}=\kappa_w\cdot(\widehat{mc}_{H,t}-\widehat{mc}_{F,t})+\beta E_t\{\widehat{\Pi}_{H,t+1}-\widehat{\Pi}_{F,t+1}\}$$

Relative real marginal cost

$$\widehat{mc}_{H,t}-\widehat{mc}_{F,t}=-\frac{1+\eta}{\eta}\widehat{q}_t-\frac{1+\eta}{\eta}(\widehat{\theta}_{H,t}-\widehat{\theta}_{F,t})+\frac{1}{\eta}(\widehat{G}_{H,t}-\widehat{G}_{F,t})+\frac{\eta+2\varsigma-1}{\eta}(\widehat{\Psi}_{H,t}-\widehat{\Psi}_{F,t})$$

Terms of trade equation

$$E_t\widehat{q}_{t+1}=\frac{1+\kappa+\beta}{\beta}\widehat{q}_t-\frac{1}{\beta}\widehat{q}_{t-1}+\frac{\kappa}{\beta}(\widehat{\theta}_{H,t}-\widehat{\theta}_{F,t})-\frac{1}{1+\eta}\frac{\kappa}{\beta}(\widehat{G}_{H,t}-\widehat{G}_{F,t})-\frac{\kappa}{\beta}\frac{\eta+2\varsigma-1}{1+\eta}(\widehat{\Psi}_{H,t}-\widehat{\Psi}_{F,t})$$

Unique tot solution

$$\widehat{q}_t=\Xi\cdot\widehat{q}_{t-1}-a_\theta(\widehat{\theta}_{H,t}-\widehat{\theta}_{F,t})+a_G(\widehat{G}_{H,t}-\widehat{G}_{F,t})+a_\Psi(\widehat{\Psi}_{H,t}-\widehat{\Psi}_{F,t})$$

$0<\Xi<1$ and $a_\theta, a_G, a_\Psi > 0$

Terms of trade do NOT depend on monetary policy

Sunspot equilibria:

Focus on equilibria in which union-wide inflation is a function of ZLB regime and of natural real interest rate:

$$\widehat{\Pi_t^B} = \mu^B + \lambda^B \hat{r}_t \quad \text{if the ZLB constraint binds at } t;$$

$$\widehat{\Pi_t^S} = \mu^S + \lambda^S \hat{r}_t \quad \text{if the ZLB constraint is slack at } t,$$

$$\text{with} \quad \gamma_\pi \widehat{\Pi_t^B} \leq -(\Pi - \beta)/\Pi < \gamma_\pi \widehat{\Pi_t^S}.$$

Assume constant transition probabilities between ZLB regimes

$$p_{ij} \equiv \text{Prob}(\widehat{\Pi_{t+1}} = \widehat{\Pi^j} \,|\, \widehat{\Pi_t} = \widehat{\Pi^i}) \text{ for } i,j \in \{S;B\}$$

Key result

For sufficiently high shock persistence:

$r_t \uparrow \Rightarrow E_t \Pi_{t+1} \downarrow$ **and** $\Pi_t \downarrow$

Calibration: mean price stickiness: 4 quarters; ρ=0.95

Cole-Obstfeld preferences (NX=0)

Equilibrium policy rules:

Permanent liquidity trap

$$\Pi_t^B = -0.0074 - 1.070\,\hat{r}_t = -0.0074 + 0.05\,\theta_t - 0.03 G_t - 0.05\,\Psi_t$$

$$Y_t^B = -0.0001 + 1.02\,\theta_t + 0.49\,G_t - 0.02\,\Psi_t$$

Permanent ZLB slack

$$\Pi_t^S = 1.77\,r_t = -0.09\,\theta_t + 0.04\,G_t + 0.09\,\Psi_t$$

$$Y_t^S = 0.97\,\theta_t + 0.51 G_t + 0.03\,\Psi_t$$

Very muted inflation response to shock

ZLB binding/slack irrelevant for shock response

IMPACT RESPONSES TO HOME GOV'T PURCHASES SHOCK (1%)

	.....Home.....					.....Foreign.....		
	i	π	GDP	TB/Y	RER	i	π	GDP
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Beliefs-driven Liq.Trap	0.00	0.24	0.66	0.00	0.15	0.00	-0.37	-0.19
Fundamental Liq.Trap	0.00	4.94	3.01	0.00	0.15	0.00	4.33	2.16
Away from ZLB	0.10	0.37	0.69	0.00	0.15	0.01	0.01	-0.16
RBC (flex-price)	--	--	0.50	0.00	0.50	--	--	0.00

- Response of union-wide GDP is close to RBC response, under inflation targeting, both in and out of liquidity trap.
- However, response of relative (Home vs. Foreign) variables is distorted by nominal rigidities. Monetary policy in MU cannot undo this distortion
- In RBC world, Home G ↑ triggers Home tot appreciation, Foreign GDP is unaffected
- In NK world: Home tot appreciation is muted

⇒ Foreign GDP falls (beliefs-driven liquidity trap)

Fundamental liquidity trap (due to adverse demand shock): baseline scenario features very sharp output increase

Large fiscal multiplier and strong cross-country spillover

Conclusion

Shock transmission in a Monetary Union stuck in a liquidity trap depends on the cause of the liquidity trap

In beliefs-driven liquidity trap: weak (negative) international fiscal spillover

Results here caution against idea of strong cross-border fiscal transmission in monetary union, in an era of low interest rates